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Growing California's Clean Tech Center

2009

Helping workforce training and education programs support green job growth in the Sacramento Region

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Valley Vision

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Purpose of report

As key conduits for expending federal stimulus dollars to support clean energy job growth, the Workforce Investment Boards serving the greater Sacramento area recognized a need to complete a rapid assessment of growing green jobs in our region, along with an inventory of the existing workforce training and education programs that support the clean energy industry. In combination, this research enabled completion of a gap analysis to identify the highest priorities for future investments in clean energy training and education programs.

The Sacramento Employment and Training Agency, Sacramento Works, and the Golden Sierra Workforce Investment Board are partnering as sponsors of this research because they recognize that the clean energy economy operates at a regional scale—businesses and employees work across jurisdictional boundaries—and thus a complimentary approach strengthens the likelihood of success for both organizations.

As a next step local clean energy employers and other expert advisors will help to define and shape the new programs that will aim to fill the biggest training and education gaps. The Workforce Investment Boards will issue Requests for Proposals (RFPs) to local education and workforce training entities to identify and fund the most qualified implementers of the new programs within the region.

DEFINING THE TYPES OF CLEAN ENERGY BUSINESSES IN THE SACRAMENTO REGION

Before jumping into the research that provides the main content of this report, it is worthwhile to clarify that this analysis focuses on four types of clean energy companies that serve the Sacramento Region. This definition mirrors the categories that the Sacramento Employment and Training Agency has been using to organize its efforts to support the clean energy sector over the past year.

1. Research and Development Companies: Establishments that conduct research and experimental development focusing on clean energy technology or energy efficiency or consult on related design and research.
2. Manufacturing and Engineering Companies: Establishments that produce clean energy technology, energy-efficiency products, or related materials and vertically integrated establishments that, in addition to producing their own products and materials, provide a full spectrum of services including engineering design and installation for complex commercial facilities.
3. Energy Efficiency Companies: Establishments that deliver large reductions in building energy use through intensive energy efficiency upgrades and on-site generation, including building performance analysis and whole-house energy-efficiency upgrades on residences, both single-family and multifamily.
4. Clean Energy Solutions Companies: Establishments that provide technical services in the design, development and utilization of clean energy solutions and third-party products (as their primary business function) and/or install and repair related items.

BROAD OVERVIEW OF THE CLEAN ENERGY SECTOR AND THE DEMAND FOR JOB PREPARATION

Numerous studies have been completed in the past year to demonstrate the potential for job and business growth in the clean energy arena across the United States. One of the most significant boosts to this sector during the recent and widespread economic downturn is the American Recovery and Reinvestment Act of 2009, which allocates $36.5 billion towards energy efficiency investments and $8 billion towards renewable energy, specifically to trigger job creation. California in particular is well positioned to benefit from the expansion of this cluster because the state has an established foundation of green firms, and policies in place to drive further demand for new energy efficiency and renewable energy investment.

Economic development experts expect that the majority of clean energy job growth will involve building a new element of "green" knowledge and skills into traditional jobs, like construction, manufacturing, sales and engineering (Cleary & Kopicki, 2009). This new knowledge must be layered on top of a strong foundation of core competencies—the basic academic and workforce readiness skills that characterize a talented employee. Furthermore, the burgeoning occupations in the clean energy sector provide high quality work opportunities for people with all levels of education and training—providing new career

paths for youth, dislocated workers, people pursuing new degrees and certifications, and workers desiring a job change (Environmental Defense Fund, 2008).

The Sacramento region is poised to experience continued expansion of its clean energy sector, building on the growth that has already happened here. In the past two years we have seen the creation of 1000+ new clean energy jobs and a doubling of the number of clean energy firms. The number of clean energy companies increased from 30-70 from 2006-2007, and increased again to over 110 at last count in February, 2009. Regional estimates from the Sacramento Area Regional Technology Alliance place job growth from the clean energy industry at over 10,000 jobs over the ten year period beginning in 2006.

Growing Clean Energy Job Opportunities in the Sacramento Region

There is no single study that has focused on gathering and analyzing data to project growth in the full range of clean energy employment opportunities in the Sacramento region. One of the challenges researchers have confronted is that increases in many types of positions are difficult to measure because emerging green jobs do not neatly fall within existing career codes tracked by the government. Additionally, many jobs are new, "greener" interpretations of traditional careers.

While we lack one reliable source to provide a predictive lens on the future of the industry in the Sacramento area, this is an energized field of study due to the national focus on clean energy job expansion as one solution to the current recession. High quality research has been completed at the state and national level, within other similar regions in California, and focusing on individual components of the clean energy sector that help guide our assessments of future opportunity areas. Furthermore, the input gathered in February, 2009 from the 35 local clean energy companies that participated in the Sacramento Region Clean Energy Roundtables is an important source of on-the-ground information about company employment and training needs.

All of these information resources help to identify likely clean energy workforce training and education needs for the Sacramento region. These fall within three realms, and each will be explained in more detail below:

1. Basic education and training needed to provide a strong foundation for clean energy sector growth and expansion
2. Career-specific education and training needed to sustain locally-established parts of the clean energy sector
3. Industry-specific education and training needed to support clean energy businesses that are newly emerging and expanding in our region and/or other parts of the state

1) Basic education and training needed to provide a strong foundation for clean energy sector growth and expansion

General Energy Literacy

During the Sacramento Region Clean Energy Roundtables we heard a consistent message from many local clean energy companies—they are interested in recruiting skilled employees from traditional jobs, like construction workers, electricians, sales representatives and HVAC installers, who can also demonstrate basic "energy literacy." This would mean that employees understand how the new energy economy relies upon distributed power generation, the basic drivers for pursuing a more sustainable energy future, and the ways to capitalize on a variety of energy efficiency and renewable energy measures to promote an integrated approach to saving energy. Courses that provide a foundation in energy literacy are an important way to offer larger numbers of people from traditional occupations the ability to find placement within a clean energy company, and save employers from having to train new workers on these industry basics.

Clean Technology Research & Development

Likewise, supporting clean energy sector expansion involves helping local research and development (R&D) companies drive innovation and new business growth in the region. Based on the feedback from our existing clean technology businesses, R&D businesses mainly need a supply of well-trained engineers. While the desired specializations can range from electrical to mechanical to environmental engineering, once again it is helpful for companies to recruit from a talent pool that has exposure to clean energy topic areas and familiarity with modern energy issues.

2) Career-specific education and training needed to support locally-established parts of the clean energy sector

The Sacramento region has an established base of occupations focused on making energy efficiency improvements and installing and servicing solar energy systems. Both of these sectors are expected to experience continued growth in the foreseeable future, and there are specific jobs that need to be trained for to support this expansion.

Energy Efficiency

Energy efficiency companies and occupations have been attracting a lot of attention for a combination of reasons. In the United States the built environment is accountable for 39% of overall energy use, and in California reducing this type of energy consumption is viewed as one of the most cost-effective ways to achieve the dramatic greenhouse gas emissions reductions mandated by the Global Warming Solutions Act (AB 32). With the passage of the American Recovery and Reinvestment Act in 2009, governments and citizens have been given a strong financial impetus to make energy efficiency investments, which is expected to further expand the market for these products and services.

A recent study completed in the San Francisco Bay Region focused on potential job growth and workforce training needs related to eight specific energy efficiency occupations. The energy efficiency sector was defined as including firms that provide energy efficiency services as their central focus, or are utilities or agencies who hire energy efficiency workers, or are large energy users who hire their own energy efficiency workers (Centers of Excellence, 2009a). A companion study of the Sacramento region is underway, and preliminary results have been released in a Key Findings report.

Eight energy efficiency occupations were evaluated as part of the study (Centers of Excellence, 2009b), and the twelve-month and three-year growth rates for each are listed in parentheses below (12-month, 3-year):

- Energy Auditor/Home Energy Rater (16.8%, 57.7%)
- Building Performance/Retrofitting Specialist (11.5%, 42.5%)
- Resource Conservation/Energy Efficiency Manager (13.9%, 31.9%)
- Compliance Analyst/Energy Regulation Specialist (8.9%, 45.6%)
- Construction/Design Project Manager (4.6%, 20.8%)
- HVAC Technicians/Installers (6.5%, 19.2%)
- Building Controls Systems Technicians (13.5%, 23.8%)
- Building Operators/Engineers (3.8%, 22.8%)

Energy Auditors and Home Energy Raters, Resource Conservation and Energy Efficiency Managers, and Building Controls Systems Technicians have the highest expected 12-month growth rate, so training needs in these fields are of immediate importance. The North State Building Industry Association is on the verge of promoting region-wide adoption of Build It Green's home energy rating system, "Green Point Rated." This could dramatically escalate demand for certified Green Point Raters in the Sacramento region.

Employers for all of the eight occupations cited the ability to effectively communicate with customers as the most valued skill for an employee, which underlines the importance of preparing people with core workforce competencies. Another skill that was repeatedly identified as important for job performance include having an understanding local and state energy efficiency requirements and incentives for existing buildings.

Over 58% of employers report having difficulty hiring for the eight occupations and the education and experience preferences for each varies considerably, as shown in Figure 1 below.

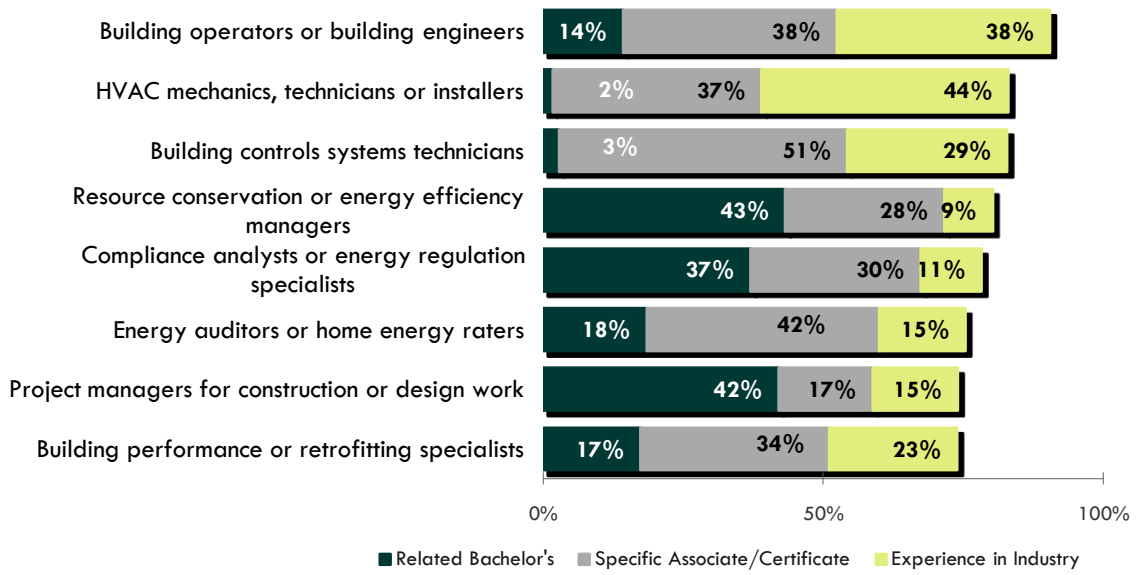

Figure 1: Education and Experience preferences for the eight energy efficiency occupations. Figure copied from data shared by the Sacramento regional study of energy efficiency occupations (Milan, 2009).

The described training, education and skill requirements for each of these energy efficiency occupation growth opportunities needs to be considered when evaluating whether the Sacramento region is adequately preparing needed workers for the future.

Solar Industry

At least half of the clean energy companies in the Sacramento region incorporate solar technology into their offerings. This follows the trend seen across California, where more than 64% of businesses in the energy generation segment of the green technology sector are focused on solar power (Collaborative Economics, 2008). Based on a recent solar industry and workforce study there are 770 solar firms in California, the majority (90-95%) are non-manufacturing, and they expect an increase in employment by up to 29% within 12 months (Centers of Excellence, 2008a). Sacramento-area solar firms are expected to add 310 new jobs during that period of time (Centers of Excellence, 2008b). This growth could increase substantially if jurisdictions in the region implement new financing mechanisms to support building energy retrofits enabled through the passage of state legislation, AB 811.

Both of the solar-focused Centers of Excellence studies elicited important industry workforce challenges and opportunities that are worth paying attention to in the Sacramento Region. Specifically the study examined five key occupations: PV Installer, Solar Thermal Installer, Sales Representative, Solar Designer/Engineer, and Installation Manager/ Project Foreman. Two-thirds of solar employers report having difficulty recruiting entry-level employees and three-fourths report difficulty recruiting

experienced employees, yet all five studied occupations show significant growth within a year. Solar thermal installers (71%) and PV installers (64%) had the highest reported projections for growth.

The employer feedback on training preferences matches the local company direction provided at the Clean Energy Roundtables. Hands-on work experience is paramount to other types of education for both kinds of installer positions. For sales representatives and estimators, most employers prefer applicants with a bachelor's or specific associate's degree, and solar designers/engineers are typically expected to have a bachelor's degree. A majority of employers (85%) expressed either "great" or "some" interest in a community college certificate programs for entry-level installers. A similar percentage of employers expressed interest in on-site, customized training for current employees.

The top four skills and abilities that were identified as most important for Sacramento-area solar employees include:

- Ability to work on a roof
- Understanding the mechanics and engineering of solar power
- Construction skills that simplify the installation
- General construction experience

3) Industry-specific education and training needed to support clean energy businesses that are emerging and expanding in our region and/or other parts of the state

There are several industries within the clean energy cluster that are emerging and expanding in the Sacramento region and the state, and present job growth opportunities in the near and mid-term. The industry segments covered in this report include: water conservation, smart grid technology, clean fuels and vehicles, wind energy, and biomass energy. While existing training programs in these areas are more limited it seems worthwhile to provide a general overview of projected growth, and to consider education and training investments to help our region catch an early wave of industry growth and activity.

Water Conservation

California's latest drought period is coinciding with a renewed policy focus on water conservation in the state; the California Building Standards Code is expected to move in the direction of mandating considerable water conservation measures (Centers of Excellence, 2008c). In advance of this decision, the North State Building Industry Association is exhibiting leadership on this issue by seeking member approval for adopting robust water conservation measures in all of their new developments in the Sacramento Region. These actions will demand new focus on training people to install water conserving technologies in the plumbing sector, and on design and layout of sustainable landscaping.

Smart Grid Technology

Implementation of smart grid technology is expected to facilitate distributed power generation, and reliance upon a greater percentage of renewable energy sources. Both SMUD and PG&E have significant focus on smart grid deployment, and are already piloting smart meters with their customers. Experts predict the period of smart grid deployment across the United States, spanning 2009 – 2012, will create 278,000 jobs, falling mainly within utilities, utility suppliers and contractors (KEMA, 2008). Sacramento State University is preparing to meet these employment needs through the launch of their new Smart Grid Center.

Clean Fuels and Vehicles

Green Capital Alliance partners at the Sacramento Air Quality Management District[1] have projected job growth in servicing and providing infrastructure for clean vehicles and alternative fuels. They expect there will be an abundance of new Plug-in Hybrid Electric Vehicles (PHEV) and Battery Electric Vehicles (BEV) in the mid-term when the California Air Resources Board's Electric Vehicle Mandate finally hits automobile manufacturers in 2012. It is not entirely clear how many PHEV versus BEV will show up and how the ratios will change over time, but it is clear that the need for installation of meters, sub-meters and the other infrastructure that will be necessary in new homes, existing homes, commercial buildings, and parking structures will create demand for trained individuals performing these green jobs.

The California Air Resources Board is still in the process of making decisions about which alternative fuels will be encouraged within the California marketplace, and a similar policy discussion is ongoing at the federal level. In the absence of policy definition, the future of the alternative fuel industry in the Sacramento region is somewhat unpredictable. One prominent local company, Pacific Ethanol, has felt the brunt of the ebb and flow of national and state policy on this topic. Following rapid expansion over the past couple of years the company now faces potential bankruptcy (Sacramento Business Journal, 2009). Nonetheless, stimulus funding investments in alternative fuel research and deployment demonstrate that these fuel technologies are still seen as a vital part of the nation's energy independence solutions.

Wind Energy

Compared to other parts of California the Sacramento region does not have a sizeable cluster of wind energy companies, but the sector is ripe for growth statewide and nationally. Wind power represented more than 40% of total new U.S. electricity generating capacity brought online in 2008 (Makower, Pernick, & Wilder, 2009). While the region may not have large wind energy job growth projections right now, the potential to serve as a west coast manufacturing site is an important one to not overlook as evidenced by Frontier Wind's decision to build turbine blades in Natomas in 2007. Attracting the industry will demand some degree of focus on wind energy within our local institutions and training programs. Fortunately, the University of California, Davis is the host institution for the California Wind Energy Collaborative, giving the region a research hub for this sector.

[1] Correspondence and conversation with Tim Taylor, SMAQMD, 3/27/09

Biomass Energy

Several biomass-focused clean energy companies participated in the 2009 Clean Energy Roundtables, and they shared the perspective that this field will experience a "breakout" in the near future. Multiple local pilot-scaled biomass projects are likely to lead to full-scale operations in the future, and will need a workforce with unique skills and familiarity with biomass energy to support this deployment. Some examples from across the region of recently launched biomass projects include:

- The Kiefer landfill and the Yolo landfill (landfill gas-to-electricity facilities)
- Placer County's forest waste-to-energy demonstration projects
- Sacramento Regional Wastewater Treatment Plant pilot grease and food waste demonstration
- UC Davis anaerobic digester demonstration for food waste

INVENTORY OF EXISTING CLEAN ENERGY WORKFORCE TRAINING AND EDUCATION PROGRAMS

Table 1 provides a condensed overview of education and training programs available and in the "pipeline" in the Sacramento Region**.** For each industry or occupation, an inventory of available programs is listed and coded to indicate whether the program is a single course or workshop, a pathway to certification or part of a college degree program. Training and education programs are grouped by sponsoring institution or association, and the table also specifies which programs offer hands-on learning opportunities and which programs satisfy continuing education requirements. A written summary of the inventory findings is included below.

General Energy Literacy

Most providers in the Sacramento Region offer at least one introductory level course or workshop pertaining to their sector or topic. These courses currently focus on providing a general overview of solar power, energy efficiency, sustainable design and incentive programs. Training opportunities are geared toward both professionals and community members. Sacramento State University Extension currently offers certificate programs in Sustainable Facility Management and Green Business Operations. A Sustainable Event and Corporate Meeting Professional Certificate is also in development.

Clean Technology Research and Development

Sacramento State University and UC Davis offer engineering and research programs for undergraduate and graduate students that develop the foundational knowledge needed to enter this field. Both universities provide opportunities for students to gain hands on experience through internships and lab work. Each university is working with external partners to create and sustain learning centers to further develop skills in their students and encourage collaborative research.

Energy Efficiency

There are several occupations in this category. A description of the available education and training opportunities is provided for each occupation.

- **Energy Auditor or Energy Home Rater:** Certified Green Point Rater courses are available through SMUD locally and online through Build it Green. LEED rating certification workshops for commercial buildings are also offered locally and online. PG&E offers energy auditing workshops with a hands-on component and most of the surveyed professional associations also sponsor workshops, test preparation and certification in this area. Cosumnes River College and Yuba College offer a LEED certification test preparation course online. Sacramento City College's Mechanical-Electrical Technology program also prepares students to work in this area, and local utility companies often hire graduates from the program.
- **Building Performance or Retro-Fitting Specialist:** Courses and workshops leading to certification in this category are available through SMUD, Yuba College, Build It Green, Solar Living Institute and the US Green Building Council. PG&E also offers workshops in this category.
- **Compliance Analyst or Energy Regulation Specialist:** American River College, Cosumnes River College and Yuba College offer courses in this category. PG&E and the Association of Energy Engineers also offer workshops in this area.
- **Project Manager for Construction or Design Work:** American River College and Yuba College offer courses leading to certification in this category. Cosumnes River College currently offers courses and had additional opportunities in the pipeline. UC Davis Extension offers certificate programs in Green Building and Renewable Energy and Green Building and Sustainable Design. Solar Energy International and the Association of Energy Engineers offer workshops leading to certification after testing. PG&E, SMUD and the Solar Living Institute all offer workshops in this area.
- **HVAC Mechanic, Technician or Installer:** Yuba College offers a test preparation course online, and Sacramento City College has an HVAC technician program in the pipeline. PG&E, SMUD and the Association of Energy Engineers offer several HVAC-related workshops.
- **Resource Conservation or Energy Efficiency Manager:** American River College currently offers a course in this category with additional educational opportunities in the pipeline. Cosumnes River College offers courses in this area and Yuba College offers courses leading to certification online. Sacramento State University Extension and UC Davis Extension offer certificate programs in this area. Workshops are also available through PG&E, SMUD, the Association of Energy Engineers and the Solar Living Institute. UC Davis is also developing an Energy Graduate Group that will prepare students to work in Energy Science and Technology or Energy Policy and Management.
- **Building Controls and Systems Technician:** Cosumnes River College offers a course in this category and Yuba College offers an online test preparation course. The Association of Energy Engineers, PG&E and Energy Star also offer workshops.
- **Building Operator or Building Engineer:** Yuba College offers an online test preparation course. PG&E, SMUD and Energy Star also offer workshops.

Solar Industry

SMUD and PG&E offer several introductory workshops for homeowners interested in learning about solar. There are also several occupation specific programs in this category. A description of the available education and training opportunities is provided for each studied occupation.

- **Solar Installation Managers or Project Foreman:** Specific training in this area is limited, although certification and degree programs for sustainable building and general construction management exist. Courses offered at American River College address the topic, and SMUD offers workshops in this area.
- **Solar Sales Representatives or Estimators:** American River College offers a course that allows students to learn about software and measuring tools used to calculate efficiency in solar systems. Most of this training currently occurs on the job.
- **Solar PV Installer or Technician:** Local utilities, community colleges and professional associations offer several training and certification opportunities in this area. There are not as many programs that offer experience in real-world work environments.
- **Solar Thermal Installer or Technician:** Similar to Solar PV training, many local utilities, community colleges and professional associations offer courses and certification opportunities in this area, yet there are not widespread programs that offer real-world work experience.

Water Conservation

Sacramento City and Folsom Lake Colleges and Sacramento State University offer certificate programs for wastewater treatment plant operators. UC Davis and Cosumnes River College offer courses in sustainable landscaping, and the Solar Living Institute provides workshops addressing sustainability in both residential and commercial landscaping.

Smart Grid Technology

Sacramento State University houses the Smart Grid Center, which allows Electronic and Electrical Engineering students specializing in Power Engineering to gain hands-on experience with the integration of smart grid technologies. This program is one of only two such programs in California.

Clean Fuels and Vehicles

The Institute for Transportation Studies at UC Davis provides opportunities for students to engage in a breadth of environmental vehicles and fuel research. The Automotive Technology Departments at American River College, Cosumnes River College and Sacramento City College also offer courses in alternative vehicle technology including hybrid electric vehicles and biodiesel.

Wind Energy

UC Davis provides training for Wind Energy Technicians through the California Wind Energy Collaborative. Additional courses related to small wind are currently in development.

Biomass Energy

Although few courses and workshops exist that are solely dedicated to biomass, many of the foundational courses at the community colleges and universities address this topic. UC Davis administers the California Biomass Collaborative, a statewide partnership focused on managing and sustaining the state's biomass for the production of renewable energy and biofuels.

Training Programs for Union Members

Several of the area's labor unions incorporate green job skills training into their 5-year apprenticeship programs. Both the Plumbers, Pipefitters, Air Conditioning and Refrigeration Program and the Northern California Sheet Metal Workers Training Program infuse green job skills training into their five year apprenticeship programs. In addition, the IBEW Sacramento Area Electrical Training Center offers courses in Energy Auditing, Energy Efficiency/Lighting Control, and Photovoltaic/Solar Installation. These programs are primarily intended to help dislocated union Electricians expand their knowledge base and skill sets.

Training Source	General Energy Educ.	Clean Tech R&D	Energy Efficiency							
	Energy Sector: General Literacy	Engineering: clean technology R&D, design	Energy Auditor or Home Energy Rater	Building Performance/ Retrofit Spclst	Compliance Analyst/ Energy Regul Specialist	Project Manager for Construction or Design Work	HVAC Mechanic, Technician or Installer	Resource Conservation or Energy Effic Mgr	Building Controls System Technician	Building Operator or Building Engineer
Community Colleges										
American River	X				X	X/P		X/P		
Cosumnes River	X		X		X	X/C		X	X	
Folsom Lake										
Sacramento City			X/C				P			
Sierra										
Yuba	X		X/T	X/T/C	X	X/C	X/T	X/C	X/S/T	X/T
Universities										
Sacramento State University	X/E	X/D						X/C		
UC Davis	X	X/D				X/S/E/D	X	X/S/E		
Utilities										
PG&E	W/S		W/S*	W*	W*	W*	W*	W*	W*	W*
SMUD	W		W/C	W/C*		W	W	W		W/C
Associations										
Assoc of Energy Engineers	W*		W/T*	W/C*	W*	W/T*	W*	W*	W*	
Build It Green			W/C	W/C*						
CA Biomass Collab, UCD										
CA Wind Energy Collab, UCD										
Energy Star	W		W						W	W
OCT, Inc.										
Sierra Building Science, Inc.			W/S/C							
Solar Energy International						X/S/C*				
Solar Living Institute	W		W	W/C*		W		W		
US Green Building Council										
Labor (training for union members)										
Intl Brotherhood of Electrical Workers Sac Training Ctr			X/S					X		
Plumbers and Pipefitters Training Center							X/S/C			
Sac Valley Sheet Metal Wrkrs			X	X			X/S/C	X		
Sheet Metal and Air Cond Contractors' Ntl Assn	W									

Table 1, page 1:

Condensed overview of education and training programs available and in the "pipeline" in the Sacramento Region (2 pages)

Table 1 Key:

- **X** Course eligible for college credit, apprenticeship
- **C** Program leads to professional certification
- **T** Preparation for test leading to certification
- **D** Program leads to Bachelor or Master degree
- **W** Workshop offered outside academic system
- ***** May be applied toward Continuing Education requirements
- **S** Skill development through hands-on learning
- **P** Programs currently in development (pipeline)
- **E** University Extension Certificate Program

Training Source	General Energy Educ.	Clean Tech R&D	Energy Efficiency							
	Energy Sector: General Literacy	Engineering: clean technology R&D, design	Energy Auditor or Home Energy Rater	Building Performance/ Retrofit Spclst	Compliance Analyst/ Energy Regul Specialist	Project Manager for Construction or Design Work	HVAC Mechanic, Technician or Installer	Resource Conservation or Energy Effic Mgr	Building Controls System Technician	Building Operator or Building Engineer
Community Colleges										
American River	X				X	X/P		X/P		
Cosumnes River	X		X		X	X/C		X	X	
Folsom Lake										
Sacramento City			X/C				P			
Sierra										
Yuba	X		X/T	X/T/C	X	X/C	X/T	X/C	X/S/T	X/T
Universities										
Sacramento State University	X/E	X/D						X/C		
UC Davis	X	X/D				X/S/E/D	X	X/S/E		
Utilities										
PG&E	W/S		W/S*	W*	W*	W*	W*	W*	W*	W*
SMUD	W		W/C	W/C*		W	W	W		W/C
Associations										
Assoc of Energy Engineers	W*		W/T*	W/C*	W*	W/T*	W*	W*	W*	
Build It Green			W/C	W/C*						
CA Biomass Collab, UCD										
CA Wind Energy Collab, UCD										
Energy Star	W		W						W	W
OCT, Inc.										
Sierra Building Science, Inc.			W/S/C							
Solar Energy International						X/S/C*				
Solar Living Institute	W		W	W/C*		W		W		
US Green Building Council										
Labor (training for union members)										
Intl Brotherhood of Electrical Workers Sac Training Ctr			X/S					X		
Plumbers and Pipefitters Training Center							X/S/C			
Sac Valley Sheet Metal Wrkrs			X	X			X/S/C	X		
Sheet Metal and Air Cond Contractors' Ntl Assn	W									

Table 1, page 2:

Condensed overview of education and training programs available and in the "pipeline" in the Sacramento Region (2 pages)

Table 1 Key:

- **X** Course eligible for college credit, apprenticeship
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GAP ANALYSIS TO IDENTIFY THE NEED FOR NEW WORKFORCE TRAINING AND EDUCATION PROGRAMS

After reviewing the potential for job expansion across the profiled clean energy sectors and comparing opportunity areas with current education and training resources, the following gaps have been identified within the workforce preparation universe. These recommendations are intended to direct investment towards supporting industry needs and growing occupations. They are based on best available information from relevant clean energy industry research and input from local clean energy company leaders, but predicting future occupation trends is an imperfect endeavor and these suggestions should be seen as open for further review and evaluation.

High priority recommendations:

- **General Energy Education—Energy literacy:** While multiple training sources provide some introductory coursework to build energy awareness, the curricula for these programs should be updated and expanded to cover the full spectrum of energy literacy issues described by local employers during the 2009 Clean Energy Roundtables. Furthermore, core energy literacy training should be offered at more training and education venues, and regularly coupled with technical training to support the industry.
- **Energy efficiency—Energy auditor**: Based on the strong growth projections for this occupation, it appears the region needs to expand the number of training providers offering these programs and provide more local venues to achieve certification (SMUD partners with Build It Green to offer the only opportunity to pursue certification within the region). If the North State Building Industry Association pursues region-wide adoption of Build It Green's "Green Point Rated" certification as expected, expanding certification opportunities for this specific program in the region will be necessary.
- **Energy efficiency—HVAC mechanic, technician or installer:** The region would benefit from an increase in available courses to serve this profession, and an expansion in the number of training providers offering these programs.
- **Energy Efficiency—Building control system technicians, building operators and engineers**: The region would benefit from broader training coverage to support these occupations. Yuba College is the only school that provides opportunities for certification in this area.
- **Energy efficiency—Building performance & retrofit specialist:** Similar to the needed expansion in energy auditors, the region will need to grow the number of training programs available to meet demand for building performance and retrofit specialists.
- **Energy efficiency—Compliance analyst or energy regulation specialist:** Employers are mainly seeking workers with Bachelor's degrees to fill this role. The region could better support this high growth occupation by focusing on adding applied coursework at the university level that can supplement existing degree programs.
- **Solar—Sales representatives and estimators:** Currently the region provides limited training opportunities for solar sales representatives and estimators, yet it is a critical industry

occupation. Many existing solar training programs focused on system installation do not prepare workers to scope and bid a project. Although American River College offers coursework in this area, additional training opportunities will need to be developed to address growing demand for this skill set.

- **Solar—PV and Solar Thermal Installers:** The region has built an impressive base of solar installation coursework available at the community college level, but most employers are seeking employees that have direct experience working on real life projects. Existing programs need to forge more robust linkages with local installation companies to create internship and apprenticeship opportunities.

Additional recommendations:

- **Clean tech R&D—Engineering:** While Sacramento State University and UC Davis offer a solid base of training for the engineering professions, students could benefit from more exposure to how their skills can be applied to clean energy applications. Increased partnerships with local industries and companies to develop internship programs could further connect local campuses to the region's green economy.
- **Energy efficiency—Project manager for construction or design work:** The region could address this workforce need by adding the option of pursuing a "Minor" in Green Building to existing four-year Construction Management degree programs. Then community colleges could focus on building a pipeline between their energy efficiency training and this Bachelor's degree program.
- **Solar—Installation managers:** Similar to the pathway described above for energy efficiency project managers, the region could support growth in this occupation by adding new, solar-specific coursework to university level programs in Construction Management. Solar training programs at the community college level could be a first step along a pipeline towards a BS degree in Construction Management with a solar-emphasis.
- **Water conservation—Sustainable landscaping:** There is only minimal coverage of this topic area in our training inventory, and it appears to be a subject area worthy of adding to programmatic offerings.
- **Water conservation—Water conservation technologies (plumbing):** Traditional plumbing training programs should incorporate a focus on installing and servicing new water conservation technologies, because this could help address the next big wave of sustainability activities that is expected for the Sacramento region.
- **Smart Grid:** The region should provide support for the rollout and expansion of the Smart Gird Center at Sacramento State University because it will serve as an innovation hub that could set the region apart from other areas. Workforce-related investments should focus on fostering hands-on training opportunities.
- **Alternative fuels and vehicles:** The region provides a good base of training in this area for now, but future expansion will likely be necessary. Specifically, it may be worthwhile to make more certifications available as occupation growth areas become more evident due to state and federal policy clarification.

- **Wind energy:** There is an opportunity to add new wind energy-focused coursework at the community college level because the region lacks any specific training on this renewable energy technology.
- **Biomass energy:** It may be worthwhile to start a focus on these this type of clean technology by creating introductory coursework on biomass energy and forging partnerships with the region's existing biomass facilities to link students and trainees to hands-on learning opportunities.

Employer Input on Filling Training Needs

After completing the inventory of green job training and education programs and the gap analysis to identify the areas demanding new focus and expansion, local clean energy employers were asked to weigh in on how to best develop workers with the necessary skills and experience to fit the high priority training needs. The following company representatives generously donated their time and expertise to this effort:

Representative(s)	Title(s)	Company/Organization	Interview Date
Kevin Davies	President & CEO	Solar Development, Inc.	June 15, 2009
Steven Adair	CEO & Founder	sageHaus	June 15, 2009
Rick Kehret	Co-Founder	Go Solar Cooperative	June 17, 2009
Louise Perez and Joan Graham	Executive Director, Deputy Director	Community Resource Project	June 17, 2009
Jason Hanson	President	Sierra Pacific Home and Comfort	June 17, 2009
Al Rich	Founder & President	SolarRoofs.com	June 17, 2009
Eric Grizzell	Resource Center Supervisor	SMUD Resource Center	June 18, 2009
Kirk Uhler	VP, Government Relations	Solar Power, Inc.	June 18, 2009
Michael Day	President	BESTCO, a division of Beutler Corporation	June 18, 2009
Ed Murray and Don Rodes	CEO, Commercial Accounts Sales Manager	Aztec Solar Inc.	June 19, 2009
Charles Segerstrom and Rosa Escutia	Energy Efficiency & Training Manager, Account Executive & Community Relations	PG&E	June 29, 2009

Company representatives were interviewed for 45-60 minutes by phone, with a focus on addressing the training areas that were most relevant to their current work and future workforce needs. They were asked to answer the following questions about each of the pertinent training areas:

1. What are the specific skills and knowledge you think an employee needs to have? What are the key elements of a training program?
2. How would someone typically gain the necessary skills/knowledge (through hands-on experience, in-house training, coursework, certifications, degrees or some combination)?
3. When you hire someone for one of these jobs, what kind of in-house training do you expect to do right now? How much time does it take? Who does your training? Would you prefer to utilize a low/no-cost outside resource?
4. Are there certain outside trainings that you think are better than others? Which ones? (offered by professional associations, community colleges, unions, etc.)
5. Do you have any ideas about how local companies could work with training providers to develop win-win partnerships?

Program recommendations have been assembled using this interview input and an overview of key findings is provided below. Certain training areas were more familiar to companies than others and thus have a greater level of detail.

Energy Efficiency—Energy auditor

Necessary skills and knowledge

- Energy auditing can be broken into two main categories: residential and commercial. Each type is associated with unique skills and knowledge:
    - Home energy audits are usually used to better understand why a person has a high energy bill, and create ways to help them save energy/money. This involves working one-on-one with homeowners, being able to clock the meter to look at energy "draws," and understanding weather stripping and other basic home improvement skills. There is a possibility that the need for residential auditors will decline with the use of smart meters, because homeowners will have more access to their energy usage information online. But working on the residential side can serve as a good training ground for the commercial side of auditing.
    - Commercial audits typically involve a higher level of sophistication. Commercial auditors are working with facilities manager and engineers. They are looking for energy savings recommendations, and advising on major purchases for large buildings. Additionally, the focus is on optimizing the performance of existing systems. There is also an account management function that goes with working with commercial customers. One company reported that there is a dire need for more commercial auditors.
- A basic site analysis demands accumulated knowledge from a variety of trades, while a full blown home performance test requires a much higher level of training and knowledge.
- Auditors are typically not making adjustments to systems; they are simply performing diagnostics and making recommendations for changes.

- There is a strong need for auditors to be able to interface with customers effectively. Account management is very important. They need to be able to share information with the customer and lay out the options effectively. This involves being able to make presentations and influence decision-making.
- In residential settings it must also be recognized that the time and effort expended to generate an audit of the caliber that would be used for commercial buildings would not be able pay for itself as easily in most cases. A typical commercial audit might take four times as long, but covers a building 50 times as large with 100 times as much energy usage. Residential customers are also covered by relatively low-cost flat tariffs, so savings that cover the cost and time of a calibrated energy model become even more difficult to obtain. For this reason, most programs are designed with "deemed savings," which, although heavily discounted are easier to administer.

Model training programs

- There is a high quality, existing program through the Association of Energy Engineers (AEE is a nonprofit professional society of 9,500 members in 73 countries). The mission of AEE is "to promote the scientific and educational interests of those engaged in the energy industry and to foster action for Sustainable Development." AEE offers a full array of informational outreach programs including seminars (live and internet based), conferences, journals, books, and certification programs. This particular program, Certified Energy Auditor, is recognized, thorough, and peer reviewed.[2]
- In residential settings there is a need for more auditors. For residential building performance the California Energy Commission's Home Energy Rating System (HERS) establishes a set of objective standards that are commonly accepted in the industry, and these are due to be updated with Phase II rules within the next several months (the original launch date was in August, 2009, but this may be delayed). The Energy Commission has authorized three organizations to certify HERS Raters, including the California Certified Energy Rating & Testing Services (CalCERTS), California Building Performance Contractors Association (CBPCA), and the California Home Energy Efficiency Rating System (CHEERS)[3]. A course could be developed that is independent of the proprietary standards of these organizations.
- SMUD reports that Sacramento City College's Mechanical Electrical Technology (MET) program is a good fit for preparing people to do auditing right now. Hands -on experience is a part of the program.
- There is a nationwide certification, Certified Energy Managers (CEM) that is also helpful, discussed in more detail in the Building Performance section below.
- PG&E has offered a 9-day course on Building Performance that has been beneficial for a company focusing on energy audits of commercial buildings, but the program has been booked up so it can be hard to get employees trained (it is a free course, with a fee for the official test)
- One company outsources their home performance testing to providers that specialize in this service, including Capital Energy Consultants and New World Management. Following-up with these companies about training needs could be very helpful.

[2] Program information from the Association of Energy Engineers is available online: http://www.aeecenter.org/certification/CEApage.htm

[3] Further information on becoming a certified HERS rater is available on the following provider websites: CalCERTS, CBPCA, and CHEERS

Trainings that are currently happening within businesses

- SMUD has created an in-house program to train new auditors using online programs that teach energy efficiency principles, commercial lighting, HVAC, etc. The program occurs over a year of time, and the trainee is paired with an experienced auditor throughout that term. Training is happening on a daily basis in many cases—using 25-50% of a new employee's paid time during the start up period. It would be desirable to have some of this training completed by outside providers, if possible.

Desired employee background

- There is interest in recruiting people that are going through the training programs—companies should be invited to recruit through the schools
- One company prefers to recruit people from the construction trades, and then send them through trainings. The employees need to be able to do hard labor, and move around comfortably in all parts of buildings. In general companies agreed that people wanting to work as residential auditors can be retrained from other trades.
- Commercial auditors usually have some understanding of applied engineering and have hands-on technical training.
- Some of the most successful auditors do not have four-year degrees, but they need to be effective troubleshooters and adept at hands-on work.

Energy Efficiency—Resource conservation and energy efficiency managers

Our level of input on this particular category of jobs was fairly low. It seemed that often employers were directing their Energy Efficiency input towards "Energy Auditing" or "Building Performance and Energy Retrofitting Specialists," and some of their feedback in those areas could overlap with what would be recommended here. The broad nature of this category made it more difficult to define the needed skills and knowledge, and the nature of model training programs.

Necessary skills and knowledge

- Help companies address environmental compliance issues, and serve as a coordinator of a business' "green" activities
- Understanding how building systems function
- Ability to do hands-on work, comfort working in the field and using tools. Book smarts are not enough for this work
- Must have a good work ethic, and good customer service skills
- Water conservation is becoming a bigger focus area within the Sacramento region. Being able to design and plant sustainable landscaping and install water-efficient appliances will become more important skills in the future.
- A big area of opportunity in the Sacramento region is the installation of fireplace inserts, which will require certification to be working on gas lines

Model training programs

- For people taking on positions as "Sustainability Coordinators," the curriculum is probably already 80% in existence, but just needs to be pulled together effectively
- There are some 2-day "Green Builder" courses available, but people who take these still need to be trained in the field by the employer
- SMUD and PG&E offer short courses that can be very valuable, and help with practical skills
- For on-the-job training it may be preferable to have people move through every rung on the ladder of the business, so they understand all parts of the business
- There is an opportunity to adjust current plumbing training curricula to include a focus on water conservation and energy literacy

Energy Efficiency—Building performance and retrofit specialist

Necessary skills and knowledge

- All of the contractors working with the Community Resource Project using federal stimulus funding through Community Services and Development are required to have certain trainings before they begin work on their projects (CSD is a state department of the California Health and Human Services Agency). As of right now some of these trainings will be offered online, but certain modules are only offered through CSD-approved training centers. For our region the PG&E training center in Stockton is the closest CSD-approved provider for many of these programs, and demand for the following courses will most likely increase as these programs roll out:
    - Basic Weatherization
    - Duct Blaster/Blower Door Diagnostics
    - Combustion Appliance Safety
    - Advanced Weatherization (minor home repair)
    - Field Assessment
    - Quality Assurance/Inspection
- PG&E expects to be a strong training partner for the CSD Weatherization programs, but before launching trainings in new locations there needs to be a critical mass of demand to ensure the new courses will be utilized
- There is a parallel need for Building inspectors to get up to date with the new technologies that are starting to be used in the region.

Model training programs

- For implementing stimulus funds, the Community Resources Project is hoping a partnership can be formed between the PG&E training center and a local community college, like American River College to increase the accessibility of CSD's required training programs. If possible, Workforce Investment Board funds could help support the expansion of the trainings offered, which should be straightforward because the CSD already has curriculum modules that are available to community partners.
- For residential building performance the California Energy Commission's Home Energy Rating System (HERS) establishes a set of objective standards that are commonly accepted in the industry,

and these are due to be updated with Phase II rules within the next several months (the original launch date was in August, 2009, but this may be delayed).

- For Commercial Building Performance, the Association of Energy Engineers again sets the standard with the Certified Energy Manager (CEM) certification that is recognized internationally as a mark of competence in understanding commercial building energy performance. They have an available training curriculum for this certification[4]. Also, the IPMVP (International Performance Measurement and Verification Protocol) exists, so the manner of conducting an audit is relatively fixed.
- The Building Performance Institute[5] offers programs that are relevant to contractors doing the retrofitting work. There are typically different businesses that analyze building performance verses actually making the improvements.

- One company recommended that the overarching approach to training programs in this area is that they should be modular and scalable. Then companies can work with an entry-level employee and build skills incrementally. If everyone spends a long time in comprehensive training programs they will expect to graduate and be placed in top positions and earning top wages, even though they have not had the hands-on experience with the company. Internal promotion of employees is much more likely.

Desired employee background

- Commercial building performance offers a good opportunity for dislocated workers needing training and to support skills upgrades and retention training for existing employees (using the CEM training program). Out-of-work HVAC employees have service experience and could be retrained to focus on building performance.
- In general, companies are looking for employees with the right character, mechanical aptitude and work ethic.
- The Community Resource Project will be recruiting employees through the Workforce Investment Boards, and will recruit subcontractors in early July for stimulus-funded projects.

Energy Efficiency—Compliance analyst or energy regulation specialist

Necessary skills and knowledge

- Regulatory compliance workers already exist in large numbers, both on the residential and non-residential sides of the equation. What is missing is something similar, but critically different: people who can model the effects of future upgrades on an existing building, and can calibrate that model not just to the way that the current building is constructed, but also to usage patterns and existing utility bills. It is difficult to use full modeling capabilities economically on residential projects. The ability to model non-residential buildings for performance exists in software, but there is a great shortage of people who know how to use the software to create the calibrated building models that can show the impact of potential energy efficiency measures. The lack of building modelers holds back implementation of energy efficiency projects because, without reliable estimates of savings, owners are reluctant to make the capital outlays required to upgrade inefficient systems.

[4] Information on AEE's CE training is available online: http://www.aeecenter.org/certification/CEMpage.htm

[5] Information on the Building Performance Institute is available online: http://www.bpi.org/content/home/index.php

- Measurement & Verification technicians are the people who verify, often as third parties, that savings are actually taking place. They are critical to performance contracting, utility incentive programs, and cap-and-trade emissions trading mechanisms.
- Compliance analysts in a residential setting need to be able to inspect a house to make sure it meet the agreed upon building standards. The downturn in the housing market has impacted growth in this area.

Model training programs

- The preferred modeling software for commercial buildings is Trace 700™ from Trane[6]. Software is expensive—it costs about $2,000 for a license and the 5-day training class has a fee on top of that.
- A standard approach and a training program exist for Measurement and Verification technicians. The protocol is the International Performance Measurement and Verification Protocol (IPMVP). The IPMVP provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. It may also be used by facility operators to assess and improve facility performance. There is training available on the IPMVP from the organization that produces it, Efficiency Valuation Organization, but while IPMVP is a gold standard it is also somewhat theoretical.[7] For somewhat more applicable training, the Association of Energy Engineers offers a Certified Measurement &Verification Professional program, which focuses on turning IPMVP theory into an actionable plan[8].
- For residential applications, the HERS Rater certification is very helpful[9].
- Currently most compliance analyst training happens on the job.

Trainings that are currently happening within businesses

- Mainly on-the-job training is happening right now.

Desired employee background

- There are many currently dislocated workers from residential new construction that have very similar skills who could be retrained to use the software Trace 700™. These individuals are the building compliance modelers from the housing boom, many of whom are now either out of work or doing something else that does not use their existing skills.
- There can be some crossover between people who have done energy auditing and building performance retrofits with people who can serve as compliance analysts in the future.

[6] Information on Trane's software programs is available online: http://www.trane.com/Commercial/Default.aspx

[7] Information on IPMVP from the organization that produces it, Efficiency Valuation Organization, is available online: http://www.evo-world.org/

[8] Information on AEE's Certified Measurement and Verification Professional program is available online: http://www.aeecenter.org/certification/

[9] Information on HERS rating is available on the Energy Star website: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS

Energy Efficiency—HVAC installation and servicing

Necessary skills and knowledge

- HVAC installers need to be able to do system troubleshooting, make sure the equipment is set properly, secured and the ducts are sealed, be able to do sheet metal work, complete the wiring to the control panel and thermostat, and make sure the system starts up properly.

Model training programs

- The Air Conditioning Contractors of America (ACCA) participated in a rigorous American National Standards Institute development process to define what a Quality Installation is for an HVAC system, but this standard has not been turned into a training program yet.[10] This is a good opportunity for market influence. Application of this standard in the field will also be a critical part of developing the Energy Star for existing homes program.
- A similar ACCA standard, Quality Maintenance, is in exactly the same situation as the Quality Installation standard, but focuses on maintaining system efficiency. It is a new standard developed through an American National Standards Institute process, but there is no curriculum to teach it yet.
- The PG&E training center in Stockton offers good HVAC trainings, but the location can be a challenge.
- One company wants to see modular training programs so employees could advance their skills over time.

Desired employee background

- Both ACCA training recommendations (Quality Installation Assurance and Quality Maintenance) offer a great opportunity to retrain existing employees and dislocated workers.

Solar—Sales representatives and estimators

Necessary skills and knowledge

- Sales representatives and estimators need to have the ability to review twelve months of a customer's energy usage and bill to analyze consumption patterns, help calculate the needed installation size, and payback period. They need to understand time of use billing verses a tiered rate structure.
- They need to know the incentives available through different utilities, and must be able to understand applicable rebates and requirements.
- Understand the basic structural characteristics of potential installations, including measuring the roof, making sure the roof can support panels, evaluate orientation, slope, shading, estimate the minimum and maximum size of the arrays, know the new state Fire Marshall guidelines, and how the solar installation will be attached to the building. They should be comfortable reviewing building drawings to evaluate project location/feasibility.

[10] Information on the ACCA standard is available online: http://www.bookmarki.com/HVAC-Quality-Installation-Specification-p/5q12007.htm

- Sales representatives and estimators are a company's first point of contact with the customer, so they need to have excellent people skills and communication skills, the ability to build rapport and trust, and ultimately make a sale. They need to be able to understand the customer's goals for making the investment. They should be able to do seminars on solar power, and make a good presentation on a project. They will also need to be able to educate the homeowner about energy efficiency, as well.
- New commercial buildings represent an opportunity area, but this means that solar sales representatives will need to be able to interface with architects and builders
- For commercial-scale projects it would be good for sales representatives and estimators to be able to get LEED certification to be able to work on buildings that are trying to achieve LEED status

- Sales representatives should have the ability to assess whether a site and project will or won't work, and the likelihood of a sale (they are often serving as the project "sorters" and should help a company focus on the best opportunities). On commercial projects they should check the customer's credit rating and know if the building is owned or leased, and know who serves as the decision-maker.
- There should be training on estimation software once sales representatives become more advanced. Software examples include On Grid, developed by Andy Black, a Solar Living Institute teacher, and PVWatts and Clean Power Estimator.
- Overall, the sales force is expected to be energy literate so they can speak knowledgeably on the overall topic area (Energy Literacy is discussed in a later section)

Model training programs

- Employers had different ideas about program structures/length, but they all seem to point towards having a curriculum united into a single course taught over a reasonably short period of time (less than a year):
    - A program could be developed that was equivalent to two weeks of intensive classroom time, spread over the course of a year, with a lot of reading and independent study in the interim.
    - Development of a single course that covered the following topics: energy literacy (2 days); solar literacy (2 weeks); solar economics (2-3 days); solar sales and marketing (1-2 days)
    - Develop a 6 week – 3 month program that happens alongside on the job training
    - Create a program that happens 2 days per week for 3 months. Create a certification in solar sales
- Reading materials should include: the California Solar Initiative handbook (CSI), the Database of State Incentives for Renewables and Efficiency (DSIRE website), certain basic pieces of the National Electric Code (NEC 690)
- Training should involve some "shadowing" of experienced sales representatives
- The Solar Living Institute offers good trainings on solar economics and paybacks, commercial-scaled project economics, and solar sales and marketing

Trainings that are currently happening within businesses

- Internal trainings are typically done in small segments:
    - One company recently provided a 4-hour training on roof surveys. This session covered how to do a site survey, explanation of different roof types, and methods of attaching installations to roofs
    - Energy literacy overview, and how solar power plays a role in energy generation
    - Evaluating when/how solar saves a customer money over time
    - Work with employees to go through presentation books, help them make the value proposition, understand the systems, and help them make a good sales presentation
- In-house training often involves shadowing another employee for 2-4 months
- Companies are using trainings offered through product manufacturers

Desired employee background

- Companies are looking for people who are easily trainable and already have sales experience. A good sales person can pick up on the work quickly, because they don't need to be overly technical.
- The following professional backgrounds can serve as a good starting point for these positions:
    - People with roofing experience because most work is on existing structures, and solar representatives should be able to advise roofing contractors on new projects
    - Commercial realty industry because they understand buildings
    - Property or facilities managers
- For commercial sales it is more common for a person to have an undergraduate degree.

Resources

- Brooks Engineering[11] has done a good job organizing training programs for the solar industry. In the past Bill Brooks has designed courses for Building Departments and other specialized audiences, and may e able to help create a curriculum for Solar Sales and Estimation.
- It would be worth building connections with locally-based manufacturers. For instance, SMA America could provide a guest lecture on inverters, to help build familiarity with that part of the solar installation. BP and Schott Solar could provide local representatives to show samples of their products, how they work, and how they are marketed.
- It may also be worth forging connections with the media, to build a better sense of the key solar projects happening around the Sacramento area and to create an understanding of the regional marketplace. The Sacramento Bee has writers that specifically cover clean energy stories, and Solar Buzz[12] serves as an industry-focused information resource—each may be willing to support training programs with up-to-date market information.
- One of our interviewees, Rick Kehret, offered to help work with training providers to refine the programs. He also said he'd like to be able to recruit from a trained talent pool.
- One of our interviewees, Al Rich, offered to help with training the trainers in the region. He is interested in helping make sure the courses are taught by effective marketers, and not people with only academic experience.

[11] Information on training courses currently offered by Brooks Engineering can be found online: http://www.brooksolar.com/

[12] Solar Buzz can be found online: http://www.solarbuzz.com/

- One of our interviewees, Kirk Uhler, explained that companies would be happy to do guest lectures on solar sales and estimation. They can also help with training the trainers.

Solar—PV and solar thermal installers

Necessary skills and knowledge

- For commercial installations one local company hires two teams of installers to specialize on different skills. Each installation is unique, so the teams can't be trained assuming a "cookie cutter" approach to the work.
    - Mechanical Team: in charge of putting in all of the hardware and modules, but are not working with hooking up the electricity. This is the first team to work on a project, and it is a bigger group (14 people for about 100 kW installation). They need to understand how to assemble and handle the modules, be familiar with building techniques and the installation hardware, know how to mount the system and tether it to the roof
    - Electrical Team: in charge of hooking up the electrical systems, need more solar experience and familiarity working with DC and AC. These individuals are required to have a California Contractor's License (C10 or C46)[13], and typically work in smaller teams (3-4 people over 2-3 weeks for a 100 kW installation). They are responsible for wiring and connecting the modules. This team is harder to hire for, and more expensive.
- The majority of the work on site is manual labor—for every 1 job that demands technical skills, you need 15 workers with labor skills. The biggest job growth opportunity is for entry-level and mid-level workers. Entry-level installers are the ones that provide the manual labor, stage the product, mount the installation on different roof types, run and band the conduit. Mid-level installers also do some measurements, troubleshooting and design work. Advanced installers or "Crew Chiefs" service the panels, set the inverters and are accountable for all of the work getting done on site.
- For solar thermal installers some jurisdictions (an example is Citrus Heights) are starting to require licensed plumbers on the job
- In general, having hands-on experience is very desirable. Employees need to be able to look at a situation and optimize a solution.
- Installers need to understand California Occupational Safety and Health requirements, because safety is a critical concern for employers. This includes how to use ropes and body harnesses, ladder safety, and other basic skills.
- Companies are looking for people with a solid work ethic, honesty and integrity. They want people that show up to work and are ready to go.
- It is important for installers to be able to interact with customers, because people are more curious about solar installations and want to understand the product. Installers need to understand that everyone is a sales person for the company. Workers need to know the basics of courteous behavior (no smoking, radios, etc.).

[13] California's directory of Contractor's Licenses is available online: http://www.cslb.ca.gov/GeneralInformation/Library/LicensingClassifications/

Model training programs

- For people who are providing the hard labor portion of the installation (like the mechanical team described above), trainings could be as minimal as 2-3 hours on a specific type of system. The warehouse can serve as the classroom, and there are easily followed assembly instructions for the panels. On the other hand, members of an "electrical team" can't be novices; they must understand solar and DC power.
- Courses could be sandwiched so there is time for on and off the job training.
- Partnerships could be formed with Solar Living Institute and Solar Energy International to design training programs.

- After students finish classes on solar thermal installation, the Community Resource Project (CRP) can provide the next step of on-the-job training. CRP could handle 20 people per two to four week training program. Or, they could partner with the installation training program at American River College so that students can finish four months of coursework there and then complete a four month module with CRP.
- One company suggested that local training programs should develop a customized class for the six-county region that covers the fire codes that are applied here, and the permitting processes within the Sacramento region.
- Solar thermal installation should become a part of existing plumbing certification programs, so providers can avoid having to create entirely new programs. People from the industry should be brought in to work with the instructor.
- One company explained that it can be difficult to have a "how to" install solar, because everyone is starting to work with patented systems that are unique.
- Training programs could have sessions with local companies, and have a chance to watch local crews at work.
- It was mentioned that PG&E offers many relevant training modules at their Stockton training facility, and that these courses are often some of the quickest ones to fill up. New solar-focused Community College programs will likely absorb some of this demand in the future.
- One company mentioned that it is worthwhile to have people complete NABCEP certification (North American Board of Certified Energy Practitioners)[14]
- In the near future HERS Raters will be involved in inspecting solar installations and doing performance verification, so the discussion about expanding HERS Phase II training from the energy efficiency sections above will also be relevant to solar energy. Likewise, installers will need to be trained on the applicable HERS evaluation standards, so they fully understand the standards they will be held accountable to.

Trainings that are currently happening within businesses

- It is mainly on-the-job training that is happening right now. People start at an entry level and work their way up.
- One company spends one hour per week on safety and technical training—they cover all kinds of topics, and the courses are incremental and ongoing.
- Most existing training programs are either too broad or too advanced, so one company accesses most of their trainings through the solar manufacturers so that employees learn about the products they are using.

[14] Information on NABCEP certification available online: http://www.nabcep.org/

- Another company focuses on weekly safety trainings, and gets most technical trainings through their manufacturers (minimal costs for these trainings).

Desired employee background

- It is easy to retrain roofers and electricians for these jobs, and this can be done in a couple of weeks of solid work and on-the-job training. Plumbers are also desirable for solar thermal installation.
- New employees are usually recruited using references from current employees, postings on craigslist, and www.solarjobs.us
- Many companies tend to recruit from within when hiring people for more advanced positions.

Resources

- John Wiles[15] could be an important resource for training materials on code compliance, and he is widely known as an expert lecturer on solar installation do's and don'ts.
- Big solar suppliers might also be willing to assist with trainings on their equipment, including Unirac and Sunlink[16].
- One company recommended building connections with the California Solar Energy Industry Association when designing training programs[17].
- A company that sells data acquisition systems, Fat Spaniel Technologies[18], is regularly offering trainings about tracking the performance of solar arrays.
- Solar Living Institute[19] has a training course, but the focus is more on system design than on installation. Solar Energy International[20] also has a 6-week online course available, but these can be expensive. Both organizations offer hands on training programs, as well.
- One interviewee, Al Rich, offered to work with local training providers to design courses, give talks and demonstrations. Also, classes could come to his factory for a field trip to see the manufacturing process.
- The Oregon Solar Energy Industry Association has a complete booklet available for free online that focuses on solar safety[21].
- One barrier to having students visit and train at work sites are the insurance and safety issues.

General Energy Education—Energy literacy

Necessary skills and knowledge

- Developing a general sense of how to do energy analysis on a building—and how to focus on saving energy first. Understand the "loading order" for energy savings.
- Understanding how to connect technologies—for instance linking wind power with solar power

[15] John Wiles is a Project Manager at the South West Technology Development Institute, a part of New Mexico State University. Contact phone number: (575) 646-6105
[16] Information on both suppliers available online: http://www.unirac.com/ and http://www.sunlink.com/
[17] Information on the California Solar Industry Association can be found online: http://calseia.org/
[18] Information on Fat Spaniel Technologies can be found online: http://www.fatspaniel.com/
[19] Solar Living International can be found online: http://www.solarliving.org/default.asp
[20] Solar Energy International can be found online: http://www.solarenergy.org/
[21] The Oregon Solar Energy Industry Association solar safety manual is available online: http://www.oregonseia.org/solar_safety_training.htm

- Building better connections between HVAC industry and other energy efficiency and renewable energy businesses
- Know the math and units of energy
- Students need to understand "lifecycle analysis" for products, to become familiar with the most sustainable options
- Being able to incorporate water conservation into the mix, and relate water savings to energy savings
- Understand the cost effectiveness of various energy saving and productions strategies
- Recognize that 1/3 of the solution to addressing greenhouse gas reduction goals is making behavioral modifications
- Know how the energy economy is changing due to smart grid technologies and more distributed power generation

Model training programs

- One company leader explained he had a positive experience going through the UCD Extension program that helped him develop a plan for shifting into becoming green-focused business from being a more traditional contractor.
- The Solar Industry Association has a lot of material available on energy literacy and education.
- PG&E and SMUD both offer relevant courses, but they need to be more broadly publicized and accessed by more people
- Training in energy literacy should reinforce participation in all of the training programs described above
- The Public Utilities Commission has identified the need to expand energy literacy at all education levels as part of their current strategic plan, so they will be active supporters and participants in making this happen

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